



HYDROGEN IMPLEMENTING AGREEMENT

FOR IMMEDIATE RELEASE

IEA Hydrogen Implementing Agreement (HIA) Task 18 Subtask B Issues Final Report on Hydrogen Demonstration Project Evaluations

The International Energy Agency (IEA) Hydrogen Implementing Agreement (HIA) Task 18, Integrated Systems - Evaluation of Hydrogen Demonstration Projects, is pleased to announce release of its Subtask B final report entitled *Demonstration Project Evaluations*. Subtask B evaluated hydrogen-based power system and hydrogen refueling system demonstration projects in Task 18 member countries. This report describes the scope of work in Phase 1 (2004-2006) of Subtask B and conveys the conclusions of its evaluations for:

- Modeling and detailed analysis of five (5) demonstrations that included technical simulations
- Analysis of three (3) demonstrations in less detail
- Case studies of eight (8) demonstrations, three of which were analyzed in detail.

The report also provides general conclusions in the areas of system evaluations, data monitoring, modeling tools, system design, control systems and cost-benefit analysis. It is available for downloading free-of-charge at [Demonstration Project Evaluations](#). “Through rigorous analysis and modeling, Subtask B’s Final Report makes a substantial contribution to the Task 18 goal of providing information on progress in the hydrogen economy,” says Task 18 Operating Agent Dr. Susan Schoenung, “Better understanding of hydrogen energy systems and fueling stations will facilitate future demonstrations and commercial deployment of hydrogen technology in participating IEA HIA countries and other nations around the world.”

The report begins with a description of the general system evaluation methodology and the hydrogen energy models and simulation tools. It then divides into two parts: Part I deals with Hydrogen Energy Systems and Part II is devoted to Hydrogen Fueling Stations. There is a mix of renewable and fossil fuel types/sources for both project types. Each project receives in-depth discussion that features the modeling and evaluation conclusions. The five demonstration systems modeled in detail include an electrolyzer-based hydrogen refueling station in Reykjavik, Iceland; a refueling station/city bus project in Malmö, Sweden; an integrated electrolyzer/metal hydride/fuel cell system at Takasago Thermal Engineering in Japan; a hydrogen and renewable integration (HARI) project in Leicestershire, UK; and a PV/hydrogen telecom system in Madrid, Spain called Fuel Cell Innovative Remote System for Telecom (FIRST) project. The three demonstrations analyzed in less detail were: a natural gas reformed-based hydrogen energy station in Las Vegas, USA; passenger vehicle hydrogen refueling station in Vancouver, Canada; and a residential solar/hydrogen system in Brunate, Italy.

Comparisons between data and models establish that the hydrogen system simulators used in the analyses are capable of evaluating systems with respect to design and operation. However, more exact data on hydrogen compressor work is required to adequately model compressor performance.

In-depth analyses underscore the importance of understanding heat exchange mechanisms and characteristics (i.e., the kinetics) of metal hydrides before designing fully integrated metal hydride systems. It is also very important that the operation of hydrogen system controls is adequately modeled in order to make a realistic assessment of hydrogen systems operation from simulations.

Analysis of the three hydrogen fueling stations indicates that there are four (4) key system design parameters for electrolyzer-based hydrogen refueling stations: 1) electrolyzer operating pressure; 2) compressor operating pressures; 3) hydrogen storage capacity; and 4) hydrogen demand (pressures and flow rates). Analysis reveals that there are optimal hydrogen compression and storage system configurations that result in improved performance. A multistage compressor and storage system with a flexible design is recommended.

Relative to system design, thermally coupled electrolyzer/metal hydride/fuel cell systems for stationary applications can have overall system efficiency up to 45-50%. Typically, demonstration systems tend to be over-sized, particularly in the case of electrolyzer-based hydrogen fueled systems. The efficiency of electrolyzer systems can be improved by 10-15% with more innovative balance of plant and operational schemes.

The report concludes that more extensive system monitoring is required for hydrogen projects. Project developers should be educated about the need for monitoring and provided with a list of measurement parameters. In general, validated hydrogen modeling tools are needed. The report recommends that development of generic hydrogen energy models should be continued across several simulation platforms. Component cost estimates and cost models need to be routinely updated. To optimize the utility of cost-benefit analyses, cost models should include replacements due to limited life, operations and maintenance costs, and installation and commissioning costs.

Finally, the report envisions that the technical evaluation methods and procedures used in Subtask B have considerable potential for application. They may be applied to different hydrogen project types as well as to projects at different stages of development, from laboratory bench scale to fully operational installations.

This effort was led by Øystein Ulleberg of the Institute for Energy Technology in Kjeller, Norway. Eight other IEA HIA members participated in Subtask B: Operating Agent Susan Schoenung of Longitude 122 West in the U.S.A.; Hiroshi Ito of AIST in Japan; Maria Hildur Maack of Icelandic New Energy; Bengt Ridell of Carl Bro Energikonsult AB (now Grontmij AB) in Sweden; Shannon Miles of Natural Resources Canada; Nick Kelly of the University of Strathclyde in the UK; Agostino Iacobazzi of ENEA in Italy and Maria del Pilar Argumosa of INTA in Spain.

For more information on Task 18, go to [IEA HIA Task 18](#). To learn more about IEA HIA contact Mary-Rose de Valladares, IEA HIA Manager at mvalladares@ieahia.org; +1 301 634 7423).